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Proposed Re-evaluation Decision

Simazine

(publié aussi en français)

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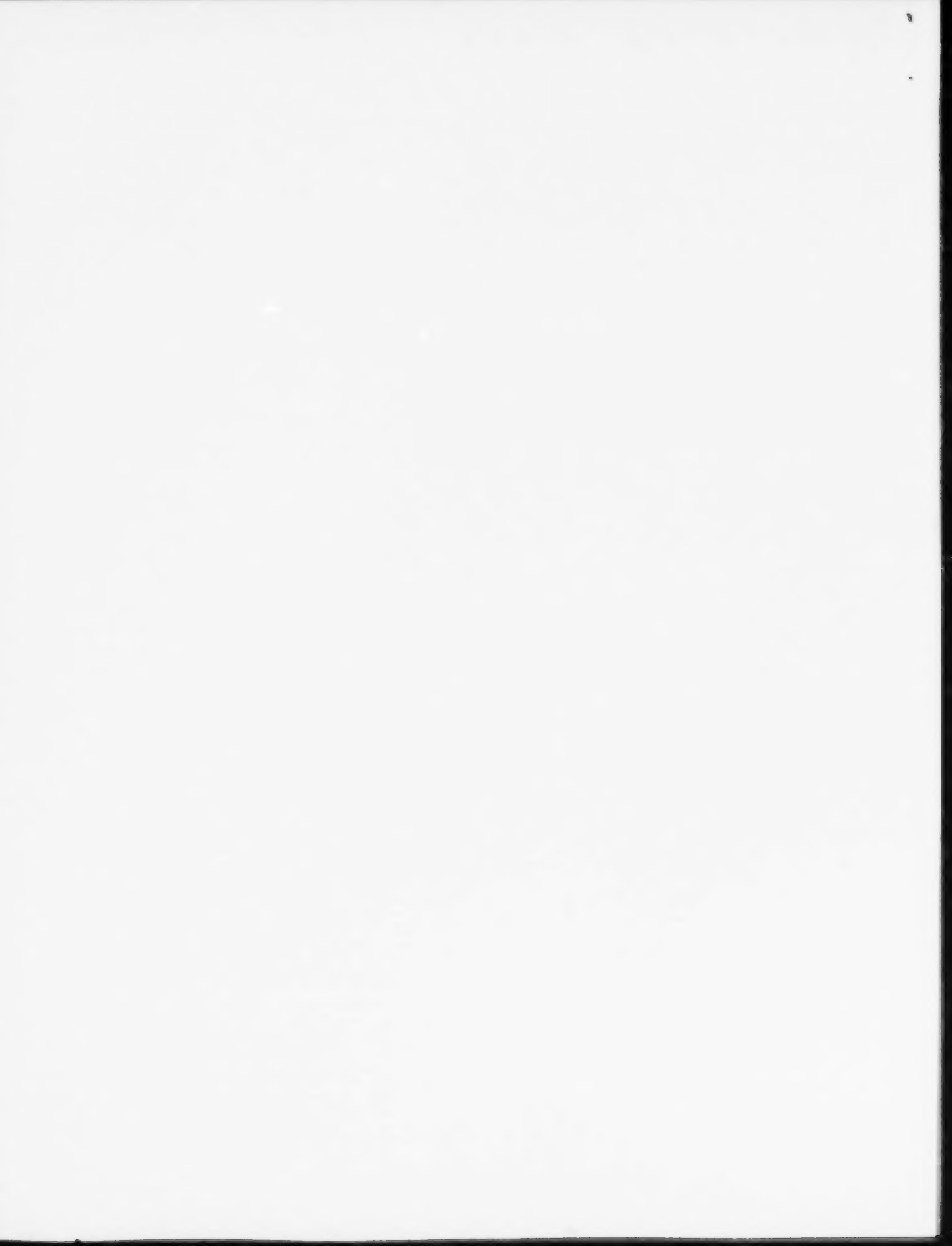
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Overview

What Is the Proposed Re-evaluation Decision?

After a re-evaluation of the herbicide simazine, Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act* and Regulations, is proposing continued registration of products containing simazine for sale and use in Canada.

An evaluation of available scientific information found that products containing simazine do not present unacceptable risks to human health or the environment when used according to label directions. As a condition of the continued registration of simazine uses, new risk-reduction measures must be included on the labels of all products.

It should be noted that for end-use products containing more than one active ingredient under re-evaluation, registration status might change as a result of the re-evaluation of the remaining affected active ingredients.

This proposal affects all end-use products containing simazine registered in Canada. Once the final re-evaluation decision is made, the registrants will be instructed on how to address any new requirements.

This Proposed Re-evaluation Decision is a consultation document¹ that summarizes the science evaluation for simazine and presents the reasons for the proposed re-evaluation decision. It also proposes additional risk-reduction measures to further protect human health and the environment.

The information is presented in two parts. The Overview describes the regulatory process and key points of the evaluation, while the Science Evaluation provides detailed technical information on the assessment of simazine.

The PMRA will accept written comments on this proposal up to 45 days from the date of publication of this document. Please forward all comments to Publications.

What Does Health Canada Consider When Making a Re-evaluation Decision?

The PMRA's pesticide re-evaluation program considers potential risks, as well as value, of pesticide products to ensure they meet modern standards established to protect human health and the environment. Regulatory Directive DIR2001-03, *PMRA Re-evaluation Program*, presents the details of the re-evaluation activities and program structure.

¹ "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

Simazine, one of the active ingredients in the current re-evaluation cycle, has been re-evaluated under Re-evaluation Program 1. This program relies as much as possible on foreign reviews, typically United States Environmental Protection Agency (USEPA) Reregistration Eligibility Decision (RED) documents. For products to be re-evaluated under Program 1, the foreign review must meet the following conditions:

- it covers the main science areas, such as human health and the environment, that are necessary for Canadian re-evaluation decisions;
- it addresses the active ingredient and the main formulation types registered in Canada; and
- it is relevant to registered Canadian uses.

Given the outcome of foreign reviews and a review of the chemistry of Canadian products, the PMRA will propose a re-evaluation decision and appropriate risk-reduction measures for Canadian uses of an active ingredient. In this decision, the PMRA takes into account the Canadian use pattern and issues (for example, the federal Toxic Substances Management Policy [TSMP]).

Based on the health and environmental risk assessments published in the 2006 RED for simazine and the 2006 Triazine Cumulative Risk Assessment, the USEPA concluded that simazine was eligible for reregistration provided risk-reduction measures were adopted. The PMRA compared the American and Canadian use patterns and found the USEPA's assessments described in this RED were an adequate basis for the proposed Canadian re-evaluation decision.

For more details on the information presented in this Overview, please refer to the Science Evaluation of this consultation document.

What Is Simazine?

Simazine is a selective systemic herbicide that is used to control germinating annual grasses and broad-leaved weeds on a variety of crops. In addition, simazine is used in shelterbelts, nursery stocks, woody ornamentals, woodlots, woodland and Christmas tree plantations, and site preparation for conifer planting. Simazine is also currently registered in Canada for "total" vegetation control in residential, agricultural and industrial non-crop areas such as patios, tennis courts, walls, paths, parking areas, and similar areas. However, this use is being voluntarily discontinued by registrants.

Simazine is applied by farm workers and professional applicators using ground equipment. Airblast equipment is also a registered application method, but only for Christmas tree and woodland plantations.

Health Considerations

Can Approved Uses of Simazine Affect Human Health?

Simazine is unlikely to affect your health when used according to the revised label directions.

People could be exposed to simazine by consuming food and water, working as a mixer/loader/applicator or by entering treated sites. The PMRA considers two key factors when assessing health risks: the levels at which no health effects occur and the levels to which people may be exposed. The dose levels used to assess risks are established to protect the most sensitive human population (children and nursing mothers, for example). Only uses for which exposure is well below levels that cause no effects in animal testing are considered acceptable for continued registration.

The USEPA concluded simazine was unlikely to affect human health provided risk-reduction measures were implemented. These conclusions apply to the Canadian situation, and equivalent risk-reduction measures are required.

Maximum Residue Limits

The *Food and Drugs Act* prohibits the sale of food containing a pesticide residue that exceeds the established maximum residue limit (MRL). Pesticide MRLs are established for *Food and Drugs Act* purposes through the evaluation of scientific data under the *Pest Control Products Act*. Each MRL value defines the maximum concentration in parts per million (ppm) of a pesticide allowed in/on certain foods. Food containing a pesticide residue that does not exceed the established MRL does not pose an unacceptable health risk.

Simazine is currently registered in Canada for use on apples, pears, loganberries, raspberries (red), grapes, asparagus, corn (field and sweet), strawberries, apricots, blackberries, cherries, filberts, hazelnuts, blueberries, peaches and plums, and could be used in other countries on crops that are imported into Canada. No specific MRLs have been established for simazine in Canada. Where no specific MRL has been established, a default MRL of 0.1 ppm applies, which means that pesticide residues in a food commodity must not exceed 0.1 ppm. However, changes to this general MRL may be implemented in the future, as indicated in the Discussion Document DIS2006-01, *Revocation of the 0.1 ppm as a General Maximum Residue Limit for Food Pesticide Residues [Regulation B.15.002(1)]*. If and when the general MRL is revoked, a transition strategy will be established to allow permanent MRLs to be set.

Environmental Considerations

What Happens When Simazine Is Introduced Into the Environment?

Simazine is unlikely to affect non-target organisms when used according to the revised label directions.

Terrestrial and aquatic species could be exposed to simazine in the environment. Environmental risk is assessed by the risk quotient method—the ratio of the estimated environmental concentration to the relevant effects endpoint of concern. In this screening level assessment, the resulting risk quotients are compared to corresponding levels of concern. A risk quotient less than the level of concern is considered a negligible risk to non-target organisms, whereas a risk quotient greater than the level of concern indicates some potential risks of concern.

The USEPA concluded that the reregistration of simazine was acceptable provided risk-reduction measures to further protect the environment were implemented. These conclusions apply to the Canadian situation, and equivalent risk-reduction measures are required. Furthermore, the PMRA will require aquatic and terrestrial buffer zones for simazine to protect aquatic organisms and non-target terrestrial plants from spray drift.

Measures to Minimize Risk

Labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human and environmental health. These directions must be followed by law. As a result of the re-evaluation of simazine, the PMRA is proposing further risk-reduction measures for product labels.

Human Health

- Additional protective equipment to protect mixer/loader/applicators
- A restricted-entry interval to protect workers re-entering treated sites
- Changes to maximum application rates on corn and strawberries, and to the number of yearly applications for strawberries
- Advisory label statement for the method of application on fruit and nut crops
- Buffer zones from wells, lakes, reservoirs, and intermittent streams and rivers to protect drinking water
- Restrictions regarding the application of simazine in fields containing tile drainage systems

Further, it is proposed to prohibit the formulation of simazine end-use products into wettable powders.

Environment

- Precautionary statements and buffer zones to protect non-target terrestrial and aquatic habitats that may contain sensitive species
- Additional groundwater and runoff advisory label statements

Next Steps

Before making a final re-evaluation decision on simazine, the PMRA will consider all comments received from the public in response to this consultation document. The PMRA will then publish a Re-evaluation Decision² document that will include the decision, the reasons for it, a summary of comments received on the proposed decision and the PMRA's response to these comments.

² "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

Science Evaluation

1.0 Introduction

Simazine is a selective systemic herbicide, which acts by inhibiting photosynthetic electron transport at the photosystem II receptor site.

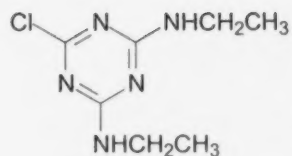
Following the re-evaluation announcement for simazine, the registrants of the technical grade active ingredient in Canada indicated that they intended to provide continued support for certain uses currently registered in Canada.

The PMRA used recent assessments of simazine from the USEPA. The USEPA Reregistration Eligibility Decision (RED) document for simazine, dated 2006, and the 2006 Triazine Cumulative Risk Assessment document as well as other information on the regulatory status of simazine in the United States can be found on the USEPA Pesticide Reregistration Status page at www.epa.gov/pesticides/reregistration/status.htm.

2.0 The Technical Grade Active Ingredient, Its Properties and Uses

2.1 Identity of the Technical Grade Active Ingredient

Common name	Simazine
Function	Herbicide
Chemical family	Triazine
Chemical name	
1 International Union of Pure and Applied Chemistry (IUPAC)	6-chloro-N ² ,N ⁴ -diethyl-1,3,5-triazine-2,4-diamine
2 Chemical Abstracts Service (CAS)	6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine
CAS Registry Number	122-34-9
Molecular formula	C ₅ H ₁₂ ClN ₃

Structural formula

Molecular weight	201.66 g/mol	
Purity of the technical grade active ingredient	97.0% nominal	97.5% nominal
Registration Number	21968	23052

2.2 Impurities of Concern in the Technical Grade Active Ingredient Simazine

The following impurities of toxicological and environmental concern were present in the simazine technical grade active ingredient:

- Hexachlorobenzene (HCB) — detected at a maximum level of 0.1 ppm
- Pentachlorobenzene (QCB) — detected at a level of less than 0.1 ppm in atrazine technical grade active ingredients

It is expected the data on HCB and QCB would be the same for atrazine and simazine produced from the same source of cyanuric chloride, where HCB and QCB contamination originates.

2.3 Physical and Chemical Properties of the Technical Grade Active Ingredient

Property	Result
Vapour pressure	2.21×10^{-8} mmHg (at 25°C)
Henry's law constant	5.6×10^{-5} Pa·m ³ ·mol ⁻¹
UV-visible spectrum	Not expected to adsorb at $\lambda > 350$ nm
Solubility in water	6.2 mg/L
<i>n</i> -Octanol-water partition coefficient	Log K_{ow} = 2.1
Dissociation constant	1.62 (at 20°C)

2.4 Comparison of Use Patterns in Canada and the United States

Simazine is a selective systemic herbicide registered in Canada to control germinating annual grasses and broad-leaved weeds. Simazine end-use products are applied prior to weed emergence in the fall, in the spring or both.

Commercial class end-use products containing simazine are currently registered for use on apples, pears, loganberries, raspberries (red), grapes, asparagus, corn (field and sweet), strawberries, apricots, blackberries, cherries, filberts, hazelnuts, blueberries, peaches and plums. In addition, simazine is used in shelterbelts, nursery stocks, woody ornamentals, woodlots, woodland and Christmas tree plantations, site preparation for conifer planting, and for "total" vegetation control (bare ground maintenance) on agricultural and industrial non-crop areas. On agricultural crops and shelterbelts, simazine is applied no more than twice a year with an application rate up to 6.75 kg a.i./ha. On agricultural and industrial non-crop areas, simazine can be applied at a rate of up to 27.36 kg a.i./ha. Commercial class end-use products containing simazine are formulated as wettable powders, dry flowable granules, suspensions or solutions, and are applied using ground using ground equipment. Airblast equipment is also a registered application method, but only for Christmas tree and woodland plantations.

There is currently one domestic class end-use product containing simazine registered in Canada for "total" vegetation control on residential non-crop areas, at a maximum application rate of 10.34 kg a.i./ha. This product is formulated as a suspension and is applied using hand-held equipment by homeowners.

"Total" vegetation control uses on agricultural, industrial and residential non-crop areas are being voluntarily discontinued by registrants. All the other registered uses are being supported by the registrants, and were, therefore, considered in the re-evaluation of simazine.

The American and Canadian use patterns were compared. Based on the comparison of formulation types, use sites, guarantees, application methods and application rates for simazine—as they appear on the current Canadian labels and are described in the USEPA RED—the following can be observed:

- The Canadian end-use product formulation types and use sites are among those registered in the United States, with the exception of asparagus, apricots and birdsfoot trefoils. However, apricots and birdsfoot trefoils belong to the same family as plums and alfalfa, respectively, which are among the uses registered in the United States. The Canadian application rates for these crops are encompassed by those assessed in the RED. Other uses of simazine registered in the United States, but not in Canada, include almonds, avocados, cabbages (grown for seed), boysenberries, citrus fruits (lemons, grapefruits, oranges), cranberries, macadamia nuts, nectarines, olives, pecans, walnuts, ornamental ponds and aquariums, and turfgrass (commercial, residential, sod farms and golf courses).

- The maximum Canadian application rate is encompassed by the maximum American application rate, and is similar to, or encompassed by, the application rates used in the USEPA's risk assessments.
- The Canadian potential application methods are among those registered in the United States.

Based on this comparison of use patterns, the PMRA concluded the USEPA RED for simazine is an adequate basis for the re-evaluation of Canadian uses of simazine. Appendix I lists all simazine products registered as of 19 March 2009, under the authority of the *Pest Control Products Act*.

3.0 Impact on Human Health and the Environment

In its 2006 RED, the USEPA concluded that the end-use products formulated with simazine met the safety standard under the American *Food Quality Protection Act* and would not pose unreasonable risks of adverse effects to humans and the environment if used according to the amended product labels. In 2006, the USEPA also published a Triazine Cumulative Risk Assessment document which assessed the risks associated with cumulative exposure to triazines.

3.1 Human Health

Toxicology studies in laboratory animals describe potential health effects resulting from various levels of exposure to a chemical and identify dose levels at which no effects are observed. Unless there is evidence to the contrary, it is assumed that effects observed in animals are relevant to humans and that humans are more sensitive to effects of a chemical than the most sensitive animal species.

In Canada, exposure to simazine may occur through consumption of food and water, while working as a mixer/loader/applicator or by entering treated sites. When assessing health risks, the PMRA considers two key factors: the levels at which no health effects occur and the levels to which people may be exposed. The dose levels used to assess risks are established to protect the most sensitive human population (children and nursing mothers, for example).

The USEPA's toxicological endpoints for assessing risk from occupational, dietary, and cumulative exposures are summarized in Appendix II. Simazine was classified by the USEPA as "not likely to be carcinogenic to humans." On this basis, cancer risk assessments were not conducted.

3.1.1 Impurities and Degradates/Metabolites of Toxicological Concern

In the USEPA's risk assessments, simazine's two chlorinated degradates, desisopropyl-s-atrazine (DIA) and diaminochlorotriazine (DACT), were considered to be of equal toxicity to the parent compound with respect to their common neuroendocrine mechanism of toxicity. Another degrade, hydroxy-simazine, was identified and was expected to have a different toxicological

profile from simazine based on the toxicological data available for an analogous metabolite for atrazine, hydroxy-atrazine. On the basis of the results of a risk assessment for hydroxy-atrazine, anticipated exposure to hydroxy-simazine in the diet was expected to be very small. Therefore, the degradate hydroxy-simazine was not included in the USEPA's human health risk assessment.

As discussed in Section 2.1, a chemistry review of Canadian products showed that HCB was found at levels of up to 0.1 ppm in one of the simazine technical grade active ingredients.

3.1.2 Occupational Exposure and Risk

Occupational risk is estimated by comparing potential exposures with the most relevant endpoint from toxicology studies being used to calculate a margin of exposure (MOE). This is compared to a target MOE incorporating safety factors protective of the most sensitive subpopulation. If the calculated MOE is less than the target MOE, it does not necessarily mean that exposure will result in adverse effects, but mitigation measures to reduce risk would be required.

Since simazine and atrazine share a common neuroendocrine mechanism of toxicity (see Section 3.1.4 for more information), and these neuroendocrine effects are considered to be the primary toxicological effects of concern for the relevant exposure durations, the USEPA concluded that atrazine data could be used as bridging data for simazine.

Workers can be exposed to simazine when mixing, loading or applying the pesticide and when entering a treated site to conduct activities such as scouting or handling treated crops.

3.1.2.1 Mixer/Loader/Applicator Exposure and Risk

Based on its use pattern, exposure to simazine is expected to occur via dermal and inhalation routes and to be of short- or intermediate-term (<6 months). Among the exposure scenarios assessed in the RED, the following nine were considered relevant to the Canadian situation:

- mixing/loading of liquids for groundboom application
- mixing/loading of wettable powders for groundboom application
- mixing/loading dry flowable granules for groundboom application
- groundboom spray application
- mixing/loading/application of liquids with a low-pressure handwand sprayer
- mixing/loading/application of liquids with a handgun sprayer
- mixing/loading/application of wettable powders with a low-pressure handwand sprayer
- mixing/loading/application of wettable powders with a handgun sprayer
- mixing/loading/application dry flowable granules concentrates with a handgun sprayer

Handler exposure analyses were performed using exposure data from the Pesticide Handlers Exposure Database, assuming baseline personal protective equipment (PPE). Increasing levels of PPE and engineering controls were evaluated for scenarios in which risks were of concern. Dermal and inhalation exposures were combined in the calculation of risk, based on a common

endpoint of toxicity. Short- and intermediate-term dermal and inhalation risks were based on maximum simazine application rates ranging from 1.12 to 17.93 kg a.i./ha.

The USEPA reported acceptable short- and intermediate-term dermal and inhalation MOEs for eight of the nine occupational exposure scenarios relevant to Canada, ranging from 110 to 35 000 (with a target MOE = 100).

For the scenario involving the application of wettable powders with a low-pressure wand on Christmas trees, shelterbelts and nurseries, the resulting estimated dermal and inhalation MOE was below the target MOE at the maximum level of protection.

Based on this, the USEPA concluded that there were potential risks of concern, particularly for those scenarios with relatively high maximum application rates. As a result, the following mitigation measures were required:

- prohibition of the use of simazine for "non-selective weed control on non-crop land"
- prohibition of the formulation of simazine into wettable powder
- reduction of the application rate on corn, grapes and peaches
- mixers and loaders of dry flowable granules for groundboom applications must wear coveralls over long-sleeve shirt and long pants, chemical-resistant footwear plus socks, chemical-resistant gloves, chemical-resistant apron, and a NIOSH-approved respirator with a dust/mist filter
- all other mixers, loaders, applicators, and other handlers of simazine end-products must wear baseline PPE and chemical-resistant gloves

Relevance to the Canadian Situation

The USEPA RED adequately addressed all potential mixer/loader/applicator exposure scenarios associated with the uses of products containing simazine in Canada, and conclusions derived from the RED apply to the Canadian situation based on the following:

- Canadian potential handler exposure scenarios are encompassed by those assessed in the RED.
- Although Canadian maximum application rates on shelterbelts, woodland and Christmas tree plantations, and site preparation for plantings are higher than the rates assessed by the USEPA for these uses, the estimated MOEs are large enough to provide sufficient protection to account for difference.

In Canada, the use of simazine for "total" vegetation control on non-crop land is being voluntarily discontinued by registrants. In order to eliminate the need to use engineering controls for the mixing and loading of dry flowable granule formulations to reduce handler risks below the level of concern (LOC), the registrants have agreed to reduce the maximum application rate of dry flowable granule formulations on shelterbelts, woodland and Christmas tree plantations. The maximum Canadian application rates for use on peaches and grapes are equivalent or lower than the American reduced rates; therefore, a rate reduction is not required in Canada. Based on this, the PMRA proposes the following mitigation measures to further protect workers:

- for liquid formulations, requiring workers to wear: chemical-resistant gloves and coveralls over baseline PPE during mixing and loading; baseline PPE during application, cleanup and repair; baseline PPE, chemical-resistant gloves and a NIOSH-approved respirator with a dust/mist filter during application using hand-held equipment
- for dry flowable granules formulations, requiring workers to wear: coveralls over baseline PPE and chemical-resistant gloves when mixing, loading and application with hand-held equipment; coveralls over baseline PPE, chemical-resistant gloves, chemical-resistant footwear, a chemical-resistant apron and a NIOSH-approved respirator with a dust/mist filter when mixing and loading dry flowable granules for groundboom application
- prohibiting the formulation of simazine into wettable powder
- reducing the maximum application rate on corn
- adding additional instructions concerning good hygiene practices to all product labels

The proposed label amendments are listed in Appendix IV.

3.1.2.2 Postapplication Exposure and Risk

The USEPA considered that inhalation exposure was negligible in postapplication scenarios, and that, based on use patterns, dermal exposure would be short-term (≤ 30 days) in duration.

The postapplication occupational risk assessment considered short-term dermal exposure to workers entering treated sites. Among the scenarios assessed in the RED, the following three were considered relevant to the Canadian situation:

- all activities except harvesting and cutting flowers/foilage following application on nurseries
- irrigation or scouting following application on Christmas trees at a rate of 4.48 kg a.i./ha (relevant for the dry flowable formulations registered in Canada)
- staking, topping, training or pruning, following application on Christmas trees at a rate of 4.48 kg a.i./ha (relevant for the dry flowable formulations registered in Canada)

The product labels of end-use products registered in the United States for use on other crops indicate application must be soil directed and contact with crop foliage must be avoided. The USEPA assumed that postapplication exposure and risks to agricultural workers contacting pesticide-treated soil are significantly lower than risks from contacting pesticide-treated foliage. Consequently, the USEPA did not conduct a quantitative assessment for use on these crops.

The USEPA used chemical-specific dislodgeable foliar residue (DFR) data and activity-specific transfer coefficients (TC) to analyze postapplication exposure from contact with treated foliage at various times after treatment. DFR data include the amount of residue that can be dislodged or transferred from a surface, such as the leaves of a plant. A TC is a factor that relates worker exposure to dislodgeable residues. TCs are specific to a given crop and activity combination (for example, hand harvesting apples or scouting late season corn) and reflect standard work clothing worn by adult agricultural workers.

The USEPA reported that for postapplication exposure, risks from simazine applied at a rate of up to 4.48 kg a.i./ha are not of concern approximately 12 hours after application in Christmas tree plantations and nurseries, for those scenarios assessed that have relatively low TCs (i.e. irrigation and scouting). However, for activities with relatively high TCs (i.e. staking and topping, training and pruning) MOEs exceeded the level of concern for dermal exposure until 48 hours after application. Mitigation measures were required as a result of this risk assessment, which included a 12-hour restricted-entry interval (REI) for all simazine end-use products as per the United States Worker Protection Standard, as well as a specific 48-hour REI for postapplication activities following application of simazine end-use products on Christmas trees.

Relevance to the Canadian Situation

The USEPA's assessment for the three occupational postapplication exposure scenarios relevant to Canada were adequately addressed in the RED, and conclusions derived from the RED apply to the Canadian situation for those uses.

In addition, the PMRA has identified two other exposure scenarios relevant to the Canadian situation:

- irrigation or scouting following application on Christmas trees at a rate of 6.40 kg a.i./ha (the maximum application rate for liquid formulations)
- staking, topping, training or pruning following application on Christmas trees at a rate of 6.40 kg a.i./ha (the maximum application rate for liquid formulations)

The PMRA conducted short-term risk assessments for these scenarios, using the USEPA's toxicological endpoints, target MOE, dermal and inhalation absorption assumptions, DFR values and TC values. For low contact activities, risks were not of concern on day 0, whereas for high contact activities, MOEs exceeded the level of concern until 21 days after application.

Based on this, the PMRA is proposing the requirement of the following mitigation measures:

- a 21-day REI for staking, topping, training and pruning of Christmas trees following the application of liquid formulations
- a 48-hour REI for staking, topping, training and pruning of Christmas trees following the application of dry flowable granule formulations
- a 12-hour REI for all other activities following the application of simazine commercial class end-use products
- an advisory statement on the label of the products used on fruit and nut crops, indicating that the application must be soil directed and that contact with crop foliage must be avoided

The proposed label amendments are listed in Appendix IV.

3.1.3 Non-Occupational Exposure and Risk

3.1.3.1 Residential Exposure

The only residential use currently registered for simazine in Canada is its use for "total" weed control on residential non-crop areas (for example: walls, driveways or tennis courts). This use is being voluntarily discontinued by registrants; therefore, residential exposure is not expected.

3.1.3.2 Exposure From Food

Acute dietary risk is calculated considering the highest ingestion of simazine that would be likely on any one day, and using food consumption and food residue values. A statistical analysis allows all possible combinations of consumption and residue levels to be combined to estimate a distribution of the amount of simazine residue that might be consumed in a day. A value representing the high end (99.9th percentile) of this distribution is compared to the acute reference dose, which is the dose at which an individual could be exposed on any given day and expect no adverse health effects. When the expected intake of residues is less than the acute reference dose, then acute dietary exposure is considered acceptable. The acute reference dose is referred to as the ARfD in Canada and, in the RED, it is expressed as the acute population adjusted dose (aPAD).

Chronic dietary risk is estimated by determining how much of a pesticide residue may be ingested with the daily diet and comparing this potential exposure to an acceptable daily intake, which is the dose at which an individual could be exposed during a lifetime and expect no adverse health effects. The acceptable daily intake is referred to as the ADI in Canada, and, in the RED, it is expressed as the chronic population adjusted dose (cPAD).

The ARfD and the ADI are based on a relevant endpoint from toxicology studies and on safety factors protective of the most sensitive subpopulation (see Appendix II). Potential residues of concern in food and drinking water are simazine plus its two chlorinated degradates, DIA and DACT.

Acute and chronic exposure through food consumption was assessed by the USEPA using field trial data, the United States Department of Agriculture's Pesticide Data Program and the Food and Drug Administration's monitoring data. Based on the available information, the USEPA found exposure to simazine through food consumption to be negligible. Acute and chronic exposure resulted in risk estimates of 0% of the aPAD for the population of concern (females ages 13–49), and 0% of the cPAD for the general American population and all subgroups. No mitigation measures were required by the USEPA with respect to exposure to simazine through food.

The Canadian application methods and maximum application rates are encompassed by those assessed in the USEPA's dietary exposure and risk assessment. Although some of the food crops registered in Canada (i.e. hazelnut, filbert, apricot) were not included in the USEPA's assessment, the PMRA considers that, based on the levels of simazine found in food, the contribution of these crops to the exposure to simazine is expected to be negligible. Therefore, the USEPA's assessment is considered to be relevant to the Canadian situation, and the conclusions derived from the RED apply to Canada.

3.1.3.3 Exposure From Drinking Water

Exposure to pesticides through drinking water can occur as a result of groundwater or surface water contamination. Simazine was found to be persistent and highly mobile in the environment, to have a strong potential to reach surface water via runoff and/or spray drift, and to contaminate groundwater via leaching. In the RED, risk from exposure through drinking water was addressed by calculating acute and chronic drinking water levels of concerns (DWLOCs). The DWLOC is the highest concentration of a pesticide in drinking water that would be acceptable considering the estimated exposure to that pesticide from food. In the USEPA's risk assessment, the DWLOCs were expressed in terms of the sum of simazine plus its two chlorinated degradates, DIA and DACT. The DWLOCs were then compared to the estimated drinking water concentrations of simazine plus DIA and DACT.

Since dietary exposure from food has been estimated at zero for simazine (see Section 3.1.3.2), the DWLOCs were based on 100% of the aPAD and cPAD. The USEPA's human health risk assessment used both monitoring and modelling data to estimate concentrations of simazine in drinking water. Monitoring data was available from the Population-Linked Exposure database and from the American registrant-supported Voluntary Monitoring Program/Atrazine Monitoring Program (VMP/AMP) for specific community water systems. Most of the Population-Linked Exposure samples were analyzed for the parent compound only, whereas the samples collected for the VMP/AMP were analyzed for simazine, DIA and DACT. A regression equation was used to derive conservative estimates of concentrations for total simazine plus DIA and DACT, when these data were not available in the databases. This equation was expected to overestimate the levels of the total triazine compounds.

Estimated maximum peak, 90-day average and annual average concentrations of simazine in surface water were calculated using the Pesticide Root Zone Model/Exposure Analysis Modelling System model. Surface water simazine concentrations were modelled based on application rates of up to 10.76 kg a.i./ha. Conservative estimates of concentrations for total simazine plus DIA and DACT were derived from a regression equation. Estimates of groundwater concentrations of simazine (parent compound only) were generated using the Screening Concentration in Ground Water model. Estimates were generated for the application of simazine at an application rate of up to 10.76 kg a.i./ha.

Surface or ground water concentrations generated from either monitoring or modelling data did not exceed the acute DWLOC. Therefore, the USEPA concluded acute exposure to simazine plus its two chlorinated degradates in drinking water is not of concern. Modelled groundwater concentrations of simazine did not exceed the chronic DWLOC for any subpopulation in all scenarios.

Modelled surface water concentrations exceeded the chronic DWLOC for the population of concern (infants and children younger than 1 year old) and are of concern for uses where simazine is applied at a broadcast rate of 4.48 kg a.i./ha or higher. Potential chronic risks of concern to infants and children younger than 1 year old were also identified based on the monitoring data. Based on this, the USEPA required the following mitigation measures:

- prohibition of the use of simazine for "non-selective weed control on non-crop land"
- reduction of maximum application rates to typical rates on corn, citrus, apples, cherries, pears, plums, peaches, nectarines, almonds, filberts, hazelnuts, macadamia nuts, pecans, walnuts, strawberries, blueberries, caneberries, avocados, cranberries, grapes, olives, nurseries, Christmas tree plantings, Shelterbelts, tree plantations and turfgrass, and harmonization of application rates on simazine product labels
- label statements advising not to apply simazine products to sand or loamy soils where the water table (groundwater) is close to the surface and where the soils are very permeable
- rate reduction and restrictions for the use on corn in areas with highly erodible soils

The USEPA also required the following setbacks and restrictions, which were previously instituted for atrazine in the 1990's to reduce water contamination:

- prohibition of mixing, loading and application within 15 m of all wells, including abandoned wells, drainage wells, and sink holes
- prohibition of mixing and loading within 15 m of intermittent streams and rivers, natural or impounded lakes and reservoirs
- prohibition of application within 20 m of points where field surface water runoff enters perennial or intermittent streams and rivers (if applied to highly erodible land, the buffer must be planted to the crop or seeded with grass or other suitable crop)
- prohibition of application within 61 m of natural or impounded lakes and reservoirs
- prohibition of application to tile-outletted terraced fields containing standpipes within 20 m of standpipes unless either immediately incorporated to a depth of 5–8 cm in the entire field or applied under a no-till practice with a high crop residue management practice is practiced (high crop residue management is described as a crop management practice where little or no crop residue is removed from the field during or after crop harvest).

The USEPA also intends to grant a request from simazine technical registrants to require a surface water community water system monitoring program with mitigation measure triggers, as part of the confirmatory data to be called-in for simazine. The program will involve frequent monitoring at any community water system with a surface source for which data indicated the concentration of simazine plus DIA and DACT exceeded, or is predicted to exceed, the chronic DWLOC for infants and children of 12 parts per billion (ppb). If the DWLOC is met or exceeded for any community water system surface water, then additional mitigation measures will be required at the associated watershed(s).

Relevance to the Canadian Situation

The Canadian application methods and maximum application rates are encompassed in the USEPA's drinking water exposure and risk assessment. Therefore, the USEPA's assessment is considered to be relevant to the Canadian situation, and the conclusions derived from the RED apply to Canada. In Canada, the use of simazine for "total" vegetation control on non-crop land is being voluntarily discontinued by registrants. The Canadian maximum application rates for the crops targeted by the USEPA's rate reductions are equal to, or lower than, the American reduced application rates, with the exception of strawberries and corn. Therefore, the PMRA proposes a rate reduction for these two crops with requirements for the following mitigation measures:

- reducing the maximum application rate on corn and strawberries
- prohibiting mixing, loading and application within 15 m of all wells, including abandoned wells, drainage wells, and sink holes
- prohibiting mixing and loading within 15 m of intermittent streams and rivers, natural or impounded lakes and reservoirs
- prohibiting application within 20 m of standpipes, in fields containing tile drainage systems, unless either immediately incorporated to a depth of 5–8 cm in the entire field or applied under a no-till practice with a high crop residue management practice.

The PMRA reviewed existing Canadian water monitoring data on file at the time of the re-evaluation (see Appendix III). Overall, available Canadian water monitoring concentrations were below the simazine concentrations recorded in the United States. Based on this review, it is unlikely that detections of simazine in Canada will exceed those in the United States.

3.1.3.4 Aggregate Risk Assessment

Aggregate risk combines the different routes of exposure to simazine (in other words, from food, water and residential exposures). Acute and chronic aggregate risk assessments are comprised of contributions from food and drinking water exposures. Short-term and intermediate aggregate risk assessments are comprised of contributions from food, drinking water and non-occupational exposure (dermal and inhalation).

In Canada, the use of simazine end-use products for "total" vegetation control on agricultural, industrial and residential non-crop areas is being voluntarily discontinued by registrants. Thus, no residential uses were expected to contribute to aggregate exposure for this chemical. Dietary exposure to simazine from food was found to be negligible by the USEPA (see Section 3.1.3.2); therefore, aggregate exposure risk estimates was based on exposure from drinking water only.

Risk estimates from exposure to simazine through drinking water were addressed in Section 3.1.3.3. Based on concerns for chronic exposure, the USEPA required measures to mitigate the risk of contamination of drinking water and the reduction of application rates to typical rates.

Overall, the Canadian potential aggregate exposure scenarios were adequately addressed by the USEPA's aggregate risk assessment. Therefore, the USEPA's aggregate exposure conclusions are considered applicable to the uses of simazine in Canada. The PMRA is requiring measures to mitigate the risk of contamination of drinking water and the reduction of application rates on corn and strawberries (see Section 3.1.3.3 for more details).

3.1.4 Cumulative Effects

The USEPA has determined that simazine shares a common mechanism of toxicity with atrazine, propazine, and the metabolites desethyl-s-atrazine (DEA), DIA and DACT, based on their ability to cause neuroendocrine and endocrine-related developmental, reproductive and carcinogenic effects. A triazine cumulative risk assessment was conducted by the USEPA in 2006 in support of the reregistration eligibility decisions for atrazine, simazine and propazine. In the United States, propazine is not registered for use on agricultural crops and is only registered for use indoors on container-grown ornamentals in greenhouses. Therefore, based on use patterns and the likelihood of exposure to these three active ingredients, only atrazine, simazine and their common metabolites (DEA, DIA and DACT) (referred to as "triazine residues") were the subject of the USEPA's risk assessment. These five compounds were considered to be equivalent in toxicity to atrazine in this assessment.

Based on available monitoring data for atrazine and simazine in or on food and in drinking water, and information on the home uses of pesticides, cumulative exposure to triazine residues in food was considered negligible. Meanwhile, cumulative exposure to triazine residues in drinking water and from home lawns and golf courses uses were considered possible. In Canada, atrazine is not currently registered for domestic vegetation control or golf course uses, and the use of simazine for "total" vegetation control on residential non-crop areas is being voluntarily discontinued by registrants; therefore, only the following exposure scenario, assessed by the USEPA, was relevant to the Canadian situation:

- single exposure pathway: via drinking water (using monitoring data or modelled exposure estimates)

In the USEPA's assessment, exposure was estimated based on data from three U.S. regions of likely high cumulative exposure to the triazine residues: Midwest, California and Florida. For the Midwest, high-end exposure estimates were based on monitoring data available for triazine residues. For California and Florida, refined exposure estimates were generated using the Pesticide Root Zone Model/Exposure Analysis Modelling System model and assuming atrazine and simazine application rates of up to 10.76 kg a.i./ha.

Based on the most appropriate combination of toxicity endpoint and period of highest concentrations of triazines residues in water, a 90-day average (intermediate-term) exposure was used for the risk assessments. Intermediate-term dietary (drinking water) risk was estimated using the Cumulative and Aggregate Risk Evaluation System.

Acceptable MOEs, ranging from 760 to 84 399—on target MOEs of 300 and 1000—were reported for infants (younger than 1 year old), children (1–2 years old), females (13–49 years old) and males (20–49 years old), which represent the most vulnerable and sensitive groups relative to the endpoint of concern. Therefore, the USEPA concluded that cumulative exposure to triazine residues through dietary exposure was not of concern.

When comparing these results with the results of the simazine risk assessment, it can be noted that potential chronic risks of concern were identified by the USEPA for the exposure to simazine through the consumption of drinking water. In the Triazine Cumulative Risk Assessment document, the USEPA concluded this difference may be the result of using older monitoring data (from 1993 to 2001) in the simazine risk assessment, which do not reflect the impact of previous mitigation measures put in place in the mid- to late-1990s. The simazine drinking water exposure assessment was also considered to be very conservative, based on the following:

- A cumulative adjustment factor was included in the triazine assessment, to account for portions of the simulated watershed that are not treated by either atrazine or simazine. Such a factor was not included in the simazine risk assessment, which was based on the assumption that the entire watershed had been treated with the chemical.
- Total chlorotriazine (DIA and DACT) residues in drinking water estimates were based on linear regression equations for the simazine risk assessment, whereas these residues were based on direct measurements in the triazine risk assessment.
- Modelled estimated drinking water concentrations were based on maximum application rates in the simazine risk assessment, whereas typical application rates were assumed in the triazine risk assessment.

Relevance to the Canadian Situation

The Canadian application methods and maximum application rates are encompassed by those assumed in the USEPA's triazine cumulative risk assessment, and propazine is not registered in Canada. Therefore, the USEPA's assessment is considered to be relevant to the Canadian situation, and the conclusions derived from the RED apply to Canada. The PMRA is proposing mitigation measures to address simazine's potential to contaminate surface and ground water as well as a reduction of the application rate on strawberries and corn (see Section 3.1.3.3).

Therefore, no additional mitigation measures are proposed with respect to cumulative exposure to triazines.

3.2 Environment

3.2.1 Fate Characteristics

Based on a laboratory aerobic soil half-life of 91 days and an anaerobic aquatic half-life of 664 days, simazine is expected to be persistent in the environment, resulting in the potential for this chemical to reach the aquatic environment by run-off. Simazine was also expected to leach into groundwater systems based on high mobility in soil. Simazine was found to photo-degrade on soil, but was found to be quite resistant to aqueous abiotic reactions. Volatilization is not expected to be an important fate process for simazine based on a low vapour pressure, and this chemical has low potential for bioaccumulation.

3.2.2 Environmental Risk Assessment

To assess the ecological risk of simazine to both terrestrial and aquatic non-target plants and animals, the USEPA calculated risk quotients (RQs) based on appropriate toxicity endpoints and expected environmental concentrations and compared the resulting RQs to corresponding LOCs. The USEPA's ecological assessment considered exposure to the parent compound (simazine) only. Available laboratory and monitoring data indicate that the three degradates of simazine commonly seen in the laboratory studies—DIA, DACT and hydroxy-simazine—will not be formed in the environment at levels that could significantly impact aquatic and terrestrial organisms.

A risk assessment for pollinators and beneficial insects was not performed because simazine was found to be practically non-toxic to honey bees. As a result, the potential for simazine to have adverse effects on pollinators and other beneficial insects was expected to be low.

In the USEPA's assessment, the calculation of expected environmental concentrations was based on application rates ranging from 1.0 kg a.i./ha to 10.76 kg a.i./ha. The USEPA determined the following:

- The chronic LOCs were exceeded for birds feeding on short grass, tall grass, broadleaf plants and small insects (RQs ranging from 1.1 to 23; LOC of 1); and mammals feeding on short grass, tall grass, broadleaf plants, small and large insects, fruits, pods and seeds (RQs ranging from 1.5 to 230; LOC of 1) at application rates of 1.12 kg a.i./ha or higher.
- The chronic LOCs were exceeded for birds feeding on large insects, fruits, pods and seeds (RQ of 1.4; LOC of 1) at an application rate of 10.76 kg a.i./ha.
- The acute LOCs were exceeded for terrestrial plants (RQs ranging from 0.3 to 117; LOC of 1) at application rates of 1.12 kg a.i./ha or higher.

- The acute LOCs were exceeded for aquatic vascular and non-vascular plants (RQs ranging from <LOC to 6.33; LOC of 1) at application rates ranging from 3.36 to 10.76 kg a.i./ha.
- The acute LOCs were not exceeded for freshwater fish and invertebrates at application rates of up to 10.76 kg a.i./ha. However, the USEPA indicated in the RED that there was a high degree of uncertainty associated with the acute freshwater data set because exposure concentrations were not verified in the available acute toxicity tests.

Acute RQ values were not calculated for estuarine/marine fish and invertebrates because the effects data indicated no adverse effects to sheepshead minnow and eastern oyster at the highest concentrations tested; therefore, the USEPA concluded that simazine is not likely to be toxic to estuarine/marine fish and invertebrates at the limit of its water solubility.

Based on concerns for acute and chronic risks to aquatic and terrestrial non-target organisms, the USEPA required mitigation measures: prohibiting the use of simazine for “non-selective weed control on non-crop land” and reducing of maximum application to typical rates.

The American use pattern for simazine encompasses the Canadian use pattern, and the USEPA’s risk-reduction measures should be applied to Canadian products containing simazine. In Canada, the use of simazine for “total” vegetation control on non-crop land is being voluntarily discontinued by registrants. The Canadian maximum application rates for the crops targeted by the USEPA’s rate reductions are equal or lower than the American reduced application rates, with the exception of strawberries and corn. Based on this, the PMRA is proposing the requirement of the following mitigation measures:

- reducing the maximum application rates on strawberries and corn
- adding advisory label statements regarding simazine’s potential toxicity to non-target organisms to all product labels
- adding a groundwater advisory statement and a statement regarding runoff to all product labels

In addition, the PMRA has calculated terrestrial and aquatic buffer zones and is proposing a requirement to minimize spray drift to non-target species during ground applications. The proposed label amendments are listed in Appendix IV. Inputs to buffer zone calculations are presented in Appendix V.

3.3 Pest Control Product Policy Considerations

3.3.1 Toxic Substances Management Policy Considerations

The management of toxic substances is guided by the federal government’s toxic substances management policy (TSMP), which puts forward a preventive and precautionary approach to deal with substances that enter the environment and could harm the environment or human health. The policy provides decision makers with direction and sets out a science-based management

framework to ensure that federal programs are consistent with its objectives. One of the key management objectives is virtual elimination from the environment of toxic substances that result predominantly from human activity and that are persistent and bioaccumulative. These substances are referred to in the policy as Track 1 substances.

During the re-evaluation, simazine was assessed in accordance with the PMRA Regulatory Directive DIR99-03, *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy*. Simazine was evaluated against the following Track 1 criteria: persistence in soil ≥ 182 days; persistence in water ≥ 182 days; persistence in sediment ≥ 365 days; persistence in air ≥ 2 days; bioaccumulation $\log K_{ow} \geq 5$ or Bioconcentration Factor (BCF) ≥ 5000 (or Bioaccumulation Factor ≥ 5000). In order for simazine or its transformation products to meet Track 1 criteria, the criteria for both bioaccumulation and persistence in one media must be met. The technical product was assessed against the contaminants identified in the *Canada Gazette*, Part II, Volume 139, Number 24, pages 2641–2643: *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern, Part 3 Contaminants of Health or Environmental Concern*.

The PMRA has concluded that simazine does meet the Track 1 criterion for persistence because the half-life values in water (664 days) exceeds the Track 1 criterion for this media. Simazine does not meet the Track 1 criterion for bioaccumulation, as its octanol–water partition coefficient ($\log K_{ow}$ 2.1) and BCF value (≤ 2.3) is below the Track 1 criterion. Although the Track 1 criterion is met for persistence in water, the criterion for bioaccumulation is not met. Given that simazine does not meet all Track 1 criteria, it is not considered a Track 1 substance.

3.3.2 Contaminants and Formulants of Health or Environmental Concern

During the review process, contaminants in the technical product are compared against the *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern* maintained in the *Canada Gazette*.³ The list is used as described in the PMRA Notice of Intent NOI2005-01⁴ and is based on existing policies and regulations including Regulatory Directives DIR99-03 and DIR2006-02,⁵ and taking into consideration the Ozone-depleting Substance Regulations (1998) of the *Canadian Environmental Protection Act* (substances designated under the Montreal Protocol). The PMRA has reached the following conclusions.

³ *Canada Gazette*, Part II, Volume 139, Number 24, pages 2641–2643: *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern* and in the order amending this list in the *Canada Gazette*, Part II, Volume 142, Number 13, pages 1611-1613. *Part 1 Formulants of Health or Environmental Concern, Part 2 Formulants of Health or Environmental Concern that are Allergens Known to Cause Anaphylactic-Type Reactions and Part 3 Contaminants of Health or Environmental Concern*.

⁴ NOI2005-01, *List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern under the New Pest Control Products Act*.

⁵ DIR2006-02, *PMRA Formulants Policy and implementation guidance document*.

- Simazine technical grade active ingredient contains several TSMP Track 1 microcontaminants, including HCB and QCB and tetrachlorobenzene (TCB). Syngenta Crop Protection Canada, Inc. has recently improved their manufacturing process and reduced the HCB concentrations in their current simazine technical production to ~0.12 ppm, a 20-fold reduction from ~2.5 ppm previously observed. The PMRA views the measures taken by Syngenta Crop Protection to reduce levels of HCB in their technical grade active ingredient as a significant step towards the TSMP goal of the virtual elimination of Track 1 substances.
- No new information was provided by Makhteshim Agan Chemical Manufacturers. Data reported in 1999 for 1998 production for HCB are also <0.1 ppm and similar to that found in the Syngenta Crop Protection Canada, Inc. technical grade active ingredient. The PMRA has determined that the data previously provided is acceptable as long as the supplier of their cyanuric chloride has not changed. Confirmation of the supplier of cyanuric chloride is required.
- QCB was found to be present at <0.1 ppm in both technical materials. No tetrachlorobenzenes have been detected at a level of quantification of 0.01 ppm.

The purpose of the TSMP is to prevent or minimize releases, with the ultimate goal of virtual elimination. The PMRA is continuing its efforts to implement the Agency's strategy to manage Track 1 contaminants in pest control products on an ongoing basis as per DIR99-03.

The regulation of formulants in registered pest control products identified in the list in the *Canada Gazette* are assessed on an ongoing basis through PMRA formulant initiatives and DIR2006-02.

4.0 Incidence reports

Since 26 April 2007, registrants of pest control products registered in Canada are required by law to report incidents, including adverse effects to health and the environment, to the PMRA within a set time frame. Incidents are classified into six major categories including effects on humans, effects on domestic animals and packaging failure. Incidents are further classified by severity from minor effects (skin rashes or headaches for humans) to major effects such as reproductive or developmental effects, life-threatening conditions or death.

The PMRA examines incident reports and, when there are reasonable grounds to suggest that the health and environmental risks of the pesticide are no longer acceptable, takes appropriate measures ranging from minor label changes to discontinuation of the product.

Available information from the PMRA database indicates two human incident reports were submitted related to simazine; however, the causality of the first incident could not be established by the PMRA because the incident occurred in the United States. The second incident occurred in Canada but was not relevant to the simazine re-evaluation.

5.0 Organisation for Economic Co-operation and Development Status of Simazine

The Organisation for Economic Co-operation and Development (OECD) comprises 30 member countries, including Canada, providing governments with a setting to discuss, develop and perfect economic and social policies. They compare experiences, share information and analyses, seek answers to common problems, and work to co-ordinate domestic and international policies to allow for consistency in practices across nations.

Based on the current available information, the use of simazine as a pesticide has been prohibited in the European Union in 2004, except for a few essential uses, based on its potential to contaminate groundwater and the length of time needed for water recovery.

In 2006, the United States assessed the registration of all uses of simazine and concluded using simazine as a pesticide does not result in unreasonable adverse effects to human health or the environment provided the risk-reduction measures recommended in its RED were implemented.

The Canadian re-evaluation of simazine is largely based on the USEPA's 2006 assessments. As described in Section 3.0, the PMRA has found the USEPA's environmental and human health risk conclusions to be relevant to the use of simazine in Canada and requires measures to mitigate those risks.

The issue identified in the European Union was taken into consideration in the re-evaluation of simazine in Canada and have been addressed in the proposed Canadian re-evaluation decision.

6.0 Proposed Re-evaluation Decision

The PMRA has determined that simazine is acceptable for continued registration with the implementation of the proposed risk-reduction measures. These measures are required to further protect human health and the environment. The labels of Canadian end-use products must be amended to include the label statements listed in Appendix IV. A submission to implement label revisions will be required within 90 days of finalization of the re-evaluation decision.

It should be noted that for end-use products containing more than one active ingredient under re-evaluation, registration status might change as a result of the re-evaluation of the remaining affected active ingredients.

7.0 Supporting Documentation

PMRA documents, such as Regulatory Directive DIR2001-03, and Data Code (DACO) tables can be found on the Pesticide and Pest Management portion of Health Canada's website at www.healthcanada.gc.ca/pmra. PMRA documents are also available through the Pest Management Information Service.

The federal TSMP is available through Environment Canada's website at www.ec.gc.ca/toxics.

The USEPA RED document for simazine is available on the USEPA Pesticide Reregistration Status page at www.epa.gov/pesticides/reregistration/status.htm.

List of Abbreviations

°C	degree(s) Celcius
µg	microgram
a.i.	active ingredient
ADI	acceptable daily intake
aPAD	acute population adjusted dose
ARfD	acute reference dose
bw	body weight
cPAD	chronic population adjusted dose
DACO	data code
DACT	diaminochlorotriazine
DFR	dislodgeable foliar residue
DIA	desisopropyl-s-atrazine
DWLOC	drinking water level of comparison
g	gram(s)
ha	hectare
HCB	hexachlorobenzene
kg	kilogram(s)
K_{ow}	<i>n</i> -octanol-water partition coefficient
L	litre(s)
LH	luteinizing hormone
LOAEL	lowest observed adverse effect level
LOC	level of concern
m ³	metre(s) cubed
mg	milligram(s)
mm Hg	millimetre mercury
MOE	margin of exposure
MRL	maximum residue limit
nm	nanometre
NOAEL	no observed adverse effect level
pH	-log ₁₀ hydrogen ion concentration
pK _a	-log ₁₀ acid dissociation constant
PMRA	Pest Management Regulatory Agency
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
QCB	Pentachlorobenzene
RED	Reregistration Eligibility Decision
REI	restricted-entry interval
RfD	reference dose
RQ	risk quotient
TC	transfer coefficient
TSMF	Toxic Substances Management Policy
USEPA	United States Environmental Protection Agency
UV	ultraviolet

Appendix I Registered Products Containing Simazine as of 19 March 2009

Registration Number	Marketing Class	Registrant	Product Name	Formulation Type	Guarantee (%)
21968	Technical	Makhteshim agan of North America Inc.	Simanex (Simazine) Technical	Dust or powder	Simazine: 97%
23052	Technical	Syngenta Crop Protection Canada, Inc.	Simazine Technical	Dust or powder	Simazine: 97.5% Related Triazines: 1%
14274	Commercial	Makhteshim agan of North America Inc.	Simanex 80W Herbicide Wettable Powder	Wettable powder	Simazine: 79% Related Triazines: 1%
15902	Commercial	Bayer Cropscience Inc.	Simadex Simazine Flowable	Suspension	Simazine: 500 g/L (41%)
16370	Commercial	Syngenta Crop Protection Canada, Inc.	Princep Nine-T Herbicide	Dry flowable granules	Simazine plus Related Triazines: 90%
23181	Commercial	United Agri Products Canada Inc.	Simazine 480 Herbicide	Solution	Simazine plus Related Triazines: 480 g/L (42%)
16645	Domestic	Sure-Gro IP Inc.	Later's Calcide Liquid Vegetation Killer	Suspension	Simazine: 3%

Note: Discontinued products and products with submission for discontinuation not included.

Appendix II Toxicological Endpoints for Simazine Health Risk Assessments

Exposure Scenario (route and period of exposure)	Dose (mg/kg bw/day)	Study	Target UF/SF or MOE ^a
Dermal Short-term ^{b,c}	NOAEL = 6.25 mg/kg bw/day Dermal absorption = 6% (human data from atrazine)	28-day Pubertal study in rats with Atrazine LOAEL = 12.5 mg/kg bw/day based on delayed preputial separation	Occupational exposure: MOE = 100 ^d
Dermal Intermediate-term ^b	NOAEL = 1.8 mg/kg bw/day Dermal absorption = 6% (human data from atrazine)	6-month luteinizing hormone (LH) surge study in rat with Atrazine LOAEL = 3.65 mg/kg bw/day based on estrous cycle alterations and LH surge suppression	Occupational exposure: MOE = 100 ^d
Dermal long-term ^b	NOAEL = 1.8 mg/kg bw/day Dermal absorption = 6% (human data from atrazine)	6-month LH surge study in rat with Atrazine LOAEL = 3.65 mg/kg bw/day based on estrous cycle alterations and LH surge suppression	Occupational exposure: MOE = 100 ^d
Inhalation Short-term ^{b,c}	NOAEL = 6.25 mg/kg bw/day	28-day Pubertal study in rats with Atrazine LOAEL = 12.5 mg/kg bw/day based on delayed preputial separation	Occupational exposure: MOE = 100 ^d
Inhalation Intermediate-term ^b	NOAEL = 1.8 mg/kg bw/day	6-month LH surge study in rat with Atrazine LOAEL = 3.65 mg/kg bw/day based on estrous cycle alterations and LH surge suppression	Occupational exposure: MOE = 100 ^d
Inhalation long-term ^b	NOAEL = 1.8 mg/kg bw/day	6-month LH surge study in rat with Atrazine LOAEL = 3.65 mg/kg bw/day based on estrous cycle alterations and LH surge suppression	Occupational exposure: MOE = 100 ^d
Acute Dietary (females ages 13–49) ^b	Developmental NOAEL = 30 mg/kg/day ARfD = 0.3 mg/kg bw/day aPAD = 0.1 mg/kg bw/day	Developmental study in rats with Simazine LOAEL = 300 mg/kg bw/day based on increased incidence of unossified teeth, head, centra vertebrae, sternabrae, and also on rudimentary ribs	UF = 100 ^d SF = 3 ^e
Acute Dietary (general U.S. population) ^b	Not applicable	No toxic effect attributable to a single dose was identified for the general U.S. population	Not applicable

Exposure Scenario (route and period of exposure)	Dose (mg/kg bw/day)	Study	Target UF/SF or MOE ^a
Chronic Dietary (all populations) ^b	NOAEL = 1.8 mg/kg bw/day Chronic RfD = 0.018 mg/kg bw/day cPAD = 0.0018 mg/kg bw/day	6-month LH surge study in rat with Atrazine LOAEL = 3.65 mg/kg bw/day based on estrous cycle alterations and LH surge suppression	UF = 100 ^d SF = 3 or 10 ^e
Dietary (drinking water only) 90-day Exposure ^c	NOAEL = 1.8 mg/kg bw/day	6-month LH surge study in rat with Atrazine LOAEL = 3.65 mg/kg bw/day based on estrous cycle alterations and LH surge suppression	UF = 100 ^d SF = 3 or 10 ^e
Incidental Oral short-term ^{b,c}	NOAEL = 6.25 mg/kg bw/day	28-day Pubertal study in rats with Atrazine LOAEL = 12.5 mg/kg bw/day based on delayed preputial separation	Occupational exposure: MOE = 100 ^d
Incidental Oral Intermediate-term ^{b,c}	NOAEL = 1.8 mg/kg bw/day	6-month LH surge study in rat with Atrazine LOAEL = 3.65 mg/kg bw/day based on estrous cycle alterations and LH surge suppression	Occupational exposure: MOE = 100 ^d
Cancer (oral, dermal, inhalation) ^b	Current classification: Reclassification by the USEPA Cancer Assessment Review Committee to "Not likely to be carcinogenic to humans" as per common mode of toxicity with atrazine.		

^a UF refers to uncertainty factors, and SF refers to FQPA safety factors, for dietary assessments; MOE refers to desired margin of exposure for occupational or residential assessments

^b From USEPA RED for simazine

^c From Triazine cumulative risk assessment

^d 10× for interspecies extrapolation; 10× for intraspecies variability

^e 3× for residual hazard-based uncertainty; 3× for uncertainty **only** when monitoring data were used to estimate drinking water exposure

Appendix III Detections of Simazine in Canadian Water Monitoring Studies

The PMRA conducted a search for detections of simazine and D-simazine in the available Canadian water monitoring data. The American monitoring data were not included since these data were already considered in the USEPA RED on which this re-evaluation is based. The available Canadian monitoring data for simazine and D-simazine are summarized in Table 1 and Table 2 and provide an indication of the potential impact of Simazine on Canadian water resources.

An important limitation of the monitoring data set is that, in many cases, the data were not accompanied with use data for simazine. For instance, the application rate applied, when the application occurred and weather conditions prior to sampling were not known or reported. Without this information, it is difficult to conclude if non-detects were a result of non-transport or more simply a result of inappropriate timing of sampling. In addition, because the data are sparse and concentrations vary in time and space, the maximum concentration reported is unlikely to be the absolute maximum concentration that would be observed in Canada. Factors that may result in higher concentrations being detected include application at higher rates, precipitation and that some areas/soils are simply more prone to leaching and/or run off. Sampling at intervals immediately following application would increase the likelihood that the maximum concentration would be detected.

Thus, it is likely simazine was not used in some of the areas monitored, and that higher concentrations of simazine may occur in other areas not monitored. The simazine monitoring data likely underestimate the peak exposure because of the following limitations:

1. In general, the data are sparse in both time and location. In some of the studies available, simazine was analyzed in samples taken from non-simazine use areas. Simazine use information from areas surrounding sample sites were collected is often not available.
2. Sampling in some of the studies was conducted during periods when simazine is not applied in Canada (October through March in other words).
3. The concentrations of pesticides in surface water are directly related to the frequency and timing of monitoring in relation to pesticide application and runoff events. Therefore, timing and frequency of sampling is likely to be the most important factor influencing the concentration detected and the frequency of detections. Samples are often taken at arbitrary time intervals (once a month or once a week, for example) and are unlikely to capture the absolute maximum concentration of simazine.

Table 1 Detections of Simazine in Canadian Water Monitoring Studies

PMRA#		Site	# of samples	# of detects	% detection	Exposure Concentrations (µg/L)				
						mean	50 th percentile	95 th percentile	maximum	Overall average
1357366		Niagara and Burlington Area	170	46	27	0.15	0.08	0.70	1.07	0.05
1357367		Great Lakes Area	207	30	14.49	0.10	0.04	0.25	0.98	0.02
1357368		Great lakes connecting channels	67	20	29.85	0.04	0.04	0.08	0.08	0.02
1357369		Lake Huron Tributaries	48	8	16.66	0.08	0.06	0.16	0.2	0.02
1307576		Laurentian Great Lakes	46	43	93	N/A	N/A	N/A	0.0431	N/A
1307578	1994	Lac Rougemont	12	11	91.7	0.29	0.07	1.21	2.10	0.27
		Ruisseau Boffin	12	7	58.3	0.09	0.08	0.18	0.20	0.05
		Wells	32	8	25	0.03	0.02	0.08	0.11	0.01
	1995	Lac Rougemont	15	12	80	0.03	0.03	0.08	0.10	0.03
		Ruisseau Boffin	13	3	23.1	0.01	0.01	0.02	0.02	0.01
		Wells	16	7	43.8	0.07	0.06	0.15	0.18	0.04
	1996	Lac Rougemont	23	2	8.7	0.02	0.02	0.02	0.02	0.01
		Ruisseau Boffin	24	1	4.2	0.02	0.02	0.02	0.02	0.01
		Wells	25	4	16	0.04	0.03	0.06	0.06	0.01
		St. Zephirin	10	4	40	0.07	0.06	0.12	0.13	0.04
1307570	1992	Chibouet	23	6	26.1	0.05	0.04	0.08	0.09	0.03
		Des Hurons	27	18	66.7	0.31	0.06	0.85	3.73	0.21
		St. Germain	24	3	12.5	0.09	0.06	0.18	0.19	0.02
		Salvail	25	3	12	0.06	0.07	0.07	0.07	0.02
		Barbue	76	43	56.6	0.07	0.06	0.17	0.35	0.05
		Noire Tem	10	3	30	0.08	0.06	0.11	0.11	0.03
		Noire	10	3	30	0.03	0.04	0.05	0.05	0.02
		Yamaska	10	4	40	0.04	0.05	0.05	0.05	0.03
		L'Acadie	9	1	11.1	0.02	0.02	0.03	0.03	0.02
		1993	St. Zephirin	29	18	62.1	0.04	0.04	0.07	0.07
	Chibouet		45	17	37.8	0.15	0.11	0.40	0.56	0.07
	Des Hurons		41	39	95.1	0.41	0.25	0.70	5.20	0.39
	St. Germain		33	2	6.1	0.05	0.05	0.06	0.06	0.02
	St. Regis		30	14	46.7	0.09	0.04	0.26	0.46	0.05
	Salvail		32	6	18.8	0.30	0.04	1.22	1.60	0.07
	Barbue		33	16	48.5	0.09	0.06	0.28	0.29	0.05
	L'Acadie		30	7	23.3	0.05	0.05	0.07	0.07	0.02
	De la Tortue		30	10	33.3	0.07	0.05	0.16	0.23	0.03
	Des Feves		26	7	26.9	0.09	0.06	0.19	0.21	0.04

PMRA#		Site	# of samples	# of detects	% detection	Exposure Concentrations (µg/L)				
						mean	50 th percentile	95 th percentile	maximum	Overall average
1307569	1994	L'Acadie	37	22	59.5	0.06	0.04	0.21	0.48	0.04
		Chibouet	34	26	76.5	0.05	0.04	0.16	0.19	0.036
		Des Hurons	35	35	100	0.10	0.04	0.46	0.88	0.096
		St. Regis	34	32	94.1	0.07	0.04	0.24	0.39	0.064
		St. Esprit	9	1	11.1	0.01	0.01	0.01	0.01	0.006
		Bayonne	9	1	11.1	0.03	0.03	0.03	0.03	0.008
		Noire	6	3	50	0.03	0.03	0.04	0.04	0.018
		Yamaska	8	6	75	0.04	0.04	0.07	0.07	0.033
	Nicolet	4	1	25	0.03	0.03	0.03	0.03	0.011	
	1995	St. Zephirin	38	7	18.4	0.03	0.02	0.07	0.08	0.010
		Chibouet	37	17	45.9	0.02	0.01	0.03	0.05	0.011
		Des Hurons	34	30	88.2	0.05	0.03	0.11	0.16	0.041
		St. Regis	35	29	82.9	0.03	0.02	0.08	0.30	0.028
		St. Esprit	6	2	33.3	0.01	0.01	0.01	0.01	0.007
		Des anges	2	1	50	0.03	0.03	0.03	0.03	0.018
		Yamaska	2	2	100	0.03	0.03	0.05	0.05	0.030
1307568		1996	St. Zephirin	39	11	2.2	0.02	0.02	0.04	0.04
	Chibouet		39	23	59	0.09	0.02	0.07	1.40	0.056
	Des Hurons		41	40	97.6	0.05	0.03	0.12	0.37	0.044
	St. Regis		41	33	80.5	0.03	0.02	0.08	0.13	0.029
	Yamaska		38	17	44.7	0.03	0.02	0.05	0.07	0.018
	1997	St. Zephirin	39	10	25.6	0.02	0.02	0.04	0.04	0.013
		Chibouet	37	12	32.4	0.02	0.02	0.02	0.02	0.013
		Des Hurons	40	38	95	0.07	0.04	0.45	0.45	0.065
		St. Regis	40	21	52.5	0.02	0.02	0.02	0.02	0.015
		Yamaska	8	8	100	0.05	0.05	0.08	0.08	0.045
	1998	St. Zephirin	45	2	4.4	0.09	0.09	0.13	0.13	0.013
		Des Hurons	45	9	20	0.09	0.06	0.22	0.22	0.026
		St. Regis	45	1	2.2	0.13	0.13	0.13	0.13	0.013
		Yamaska	49	12	24.5	0.03	0.03	0.04	0.04	0.014
1307571	1999	St. Zephirin	46	1	2.2	0.01	0.01	0.01	0.01	0.01
		Chibouet	45	9	20	0.02	0.02	0.03	0.04	0.01
		Des Hurons	45	19	42.2	0.05	0.02	0.12	0.20	0.02
		St. Regis	45	9	20	0.01	0.01	0.02	0.02	0.01
		Yamaska	45	20	44.4	0.02	0.02	0.04	0.07	0.01
	2000	St. Zephirin	40	2	5.0	0.03	0.03	0.03	0.03	0.01
		Chibouet	42	3	7.1	0.03	0.03	0.03	0.03	0.01
		Des Hurons	43	14	32.6	0.06	0.05	0.13	0.026	0.02
		St. Regis	43	15	34.9	0.04	0.03	0.08	0.13	0.02
	2001	St. Zephirin	46	2	4.3	0.02	0.02	0.02	0.02	0.01
		Chibouet	44	1	2.3	0.02	0.02	0.02	0.02	0.01
		Des Hurons	45	12	26.7	0.05	0.03	0.19	0.25	0.02
		St. Regis	46	11	23.9	0.05	0.03	0.15	0.21	0.02
		Yamaska	45	19	42.2	0.03	0.03	0.06	0.08	0.02

PMRA#		Site	# of samples	# of detects	% detection	Exposure Concentrations (µg/L)				
						mean	50 th percentile	95 th percentile	maximum	Overall average
1398453	2002	St. Zephirin	40	3	7.5	0.02	0.02	0.029	0.03	0.01
		Chibouet	43	6	14	0.02	0.02	0.04	0.04	0.01
		Des Hurons	42	28	66.7	0.04	0.025	0.09	0.24	0.03
		St. Regis	41	21	51.2	0.047	0.03	0.11	0.17	0.03
	2003	St. Zephirin	39	1	2.6	0.01	0.01	0.01	0.01	0.01
		Chibouet	41	1	2.4	0.1	0.1	0.1	0.1	0.01
		Des Hurons	41	15	36.6	0.025	0.015	0.053	0.06	0.01
		St. Regis	39	1	2.6	0.01	0.01	0.01	0.01	0.01
	2004	St. Zephirin	39	2	5.1	0.015	0.015	0.02	0.02	0.01
		Chibouet	40	8	20	0.03	0.02	0.07	0.08	0.01
		Des Hurons	41	4	9.8	0.025	0.01	0.04	0.04	0.01
		St. Regis	39	2	5.1	0.015	0.015	0.02	0.02	0.01
1311143		Alberta Treated water Survey (1995-2003)	995	N/A	N/A	N/A	N/A	N/A	N/A	
1307573		Manitoba (1986-1994)	1048	48	4.58	N/A	N/A	N/A	11	N/A
1345923		St. Lawrence River	52	N/A	N/A	N/A	N/A	N/A	0.013	N/A
1311111 and 131112		Pacific and Yukon Region	47	24	51.06	N/A	N/A	N/A	2.37	N/A
		Ontario Region	56	20	35.71	N/A	N/A	N/A	0.332	N/A
		Québec Region	120	43	35.83	N/A	N/A	N/A	0.016	N/A
1311110		British Columbia	20	4	20	N/A	N/A	N/A	0.0128	N/A
1311126		P.E.I water Annex	35	21	60	N/A	N/A	N/A	0.154	N/A
1311128		Manitoba	382	8	2.1	0.0024	0.00181	0.0054	0.0054	0.00025
1311130		Manitoba Conservatio n	1943	32	1.65	0.003	0.0015	0.013	0.23	0.00026
1311131	2001	Manitoba	99	2	2	0.33	0.33	0.41	0.42	0.07
	2002	Water	125	2	1.6	1.3	1.3	1.75	1.8	0.9
	2003	Stewardship	65	2	3.07	0.3	0.3	0.39	0.4	0.106

Table 2 Detected Concentrations of D-Simazine in Canadian Water Monitoring Data

PMRA#		Site	# of samples	# of detects	% detection	Exposure Concentrations (µg/L)				
						mean	50 th percentile	95 th percentile	maximum	Overall average
1357366		Niagara and Burlington Area	170	4	2.35	0.367	0.352	0.5711	0.581	0.0158
1357367		Great Lakes Area	207	1	0.48	0.206	0.206	0.206	0.206	0.074
1357368		Great Lakes connecting Channels	67	0	0	0	0	0	0	0
1357369		Lake Huron Tributaries	47	0	0	0	0	0	0	0
1307576		Laurentian Great Lakes	4	4	100	N/A	N/A	N/A	0.281	N/A
1307569	1994	St. Zephirin	37	36	97.3	0.13	0.09	0.29	0.85	0.123
		Chibouet	45	36	80	0.18	0.14	0.48	0.61	0.144
		Des Hurons	47	45	95.7	0.13	0.12	0.31	0.40	0.117
		St. Regis	34	30	88.2	0.11	0.09	0.22	0.29	0.100
		St. Esprit	9	1	11.1	0.24	0.24	0.24	0.24	0.040
		Des anges	10	10	100	0.14	0.06	0.40	0.41	0.143
		Bayonne	9	2	22.2	0.22	0.22	0.29	0.30	0.059
		Noire	6	4	66.7	0.21	0.16	0.43	0.48	0.142
		Yamaska	8	5	62.5	0.23	0.18	0.50	0.55	0.151
		Nicolet	4	1	25	0.10	0.10	0.10	0.10	0.036
	1995	St. Zephirin	38	38	100	0.13	0.10	0.41	0.50	0.135
		Chibouet	38	38	100	0.14	0.10	0.33	0.42	0.138
		Des Hurons	34	30	88.2	0.10	0.08	0.24	0.29	0.094
		St. Regis	35	35	100	0.11	0.07	0.35	0.41	0.114
		St. Esprit	6	5	83.3	0.15	0.17	0.24	0.25	0.129
		Des anges	2	2	100	0.35	0.35	0.54	0.56	0.345
		Yamaska	2	2	100	0.20	0.20	0.23	0.23	0.200
1311111 and 131112		Ontario Region	56	5	8.9	N/A	N/A	N/A	0.19	N/A

Appendix IV Label Amendments for Products Containing Simazine

The label amendments presented below do not include all label requirements for individual end-use products, such as first aid statements, disposal statements, precautionary statements and supplementary protective equipment. Additional information on labels of currently registered products should not be removed unless it contradicts the above label statements.

A submission to request label revisions will be required within 90 days of finalization of the re-evaluation decision.

Domestic Class Products

The labels of Domestic Class end-use products in Canada must be amended to include the following statements to further protect workers and the environment.

- I) The guarantee statement on the front panel of product labels must be amended to include the content in other triazines as follows.

Simazine% and related triazines.....%

- II) The following statements must be included in a section entitled “**PRECAUTIONS**” on product labels.

Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.

Keep children and pets away from treated areas, at least until spray has dried.

Commercial Class Products

The labels of commercial class end-use products in Canada must be amended to include the following statements to further protect workers and the environment.

- I) The use for “total” weed control on agricultural, industrial and domestic non-crop areas is being voluntarily discontinued by registrants; references to this use must be removed from the relevant labels.
- II) The guarantee statement on the front panel of product labels must be amended to include the content in other triazines as follows:

Simazine% and related triazines.....%

- III) Maximum application rates indicated in the last two columns of the table below must be included on the end-use product labels:

Uses	Currently on labels		Required application rates	
	Maximum rate per application (kg a.i./ha)	Maximum number of application per year	Maximum rate per application (kg a.i./ha)	Maximum number of application per year
Strawberries	1.80	2	1.12	1
Corn (sweet and field): for application on soils that are not highly erodible or on highly erodible soil if at least 30% of the soil is covered with plant residues (liquid formulations only)	Sweet: 2.25 Field: 4.00	1	2.25	1
Corn (sweet and field): for application on soils that are not highly erodible or on highly erodible soil if at least 30% of the soil is covered with plant residues (dry flowable granule formulations only)	Sweet: 2.25 Field: 4.00	1	2.0	1
Corn (sweet and field): for application on highly erodible soil if less than 30% of the soil is covered with plant residues	Sweet: 2.25 Field: 4.00	1	1.79	1
Shelterbelts (dry flowable granule formulations only)	6.75	1	4.48	1
Woodland and Christmas tree plantations (dry flowable granule formulations only)	6.40	1	4.48	1

- IV) The following statements must be included in a section entitled "**PRECAUTIONS**" on product labels:

For liquid formulations:

Wear coveralls over a long-sleeved shirt and long pants, and chemical-resistant gloves during mixing/loading. Wear a long-sleeved shirt and long pants during application, cleanup and repair. In addition, wear chemical-resistant gloves and a NIOSH-approved respirator with a dust/mist filter during application using hand-held equipment.

For dry flowable granule formulations:

Wear coveralls over a long-sleeved shirt and long pants, and chemical-resistant gloves during mixing/loading. In addition, wear chemical-resistant footwear, a chemical-resistant apron and a NIOSH-approved respirator with a dust/mist filter during mixing/loading of dry flowable granules for groundboom application.

For all formulations:

Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.

Users should remove clothing immediately if pesticide comes in contact with skin through soaked clothing or spills. Then wash skin thoroughly and put on clean clothing. Wash contaminated clothing before reuse.

Users should remove personal protective equipment immediately after handling this product. Wash the outside of the gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

Discard clothing or other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them.

- V) The following statements must be included in a section entitled "**DIRECTIONS FOR USE**" on product labels:

For liquid formulations:

DO NOT enter or allow worker entry into treated areas for 12 hours following application (except for stacking, topping, training and pruning in Christmas tree and woodland plantations). **DO NOT** enter or allow worker entry for staking, topping, training and pruning in Christmas tree and woodland plantations for 21 days following application.

For dry flowable granule formulations:

DO NOT enter or allow worker entry into treated areas for 12 hours following application (except for stacking, topping, training and pruning in Christmas tree and woodland plantations). **DO NOT** enter or allow worker entry for staking, topping, training and pruning in Christmas tree and woodland plantations for 48 hours following application.

For all formulations:

For fruit and nut crop: Apply the spray to the orchard or vineyard floor, avoiding contact with fruit, foliage or stems.

Field sprayer application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** apply with spray droplets smaller than the American Society of Agricultural Engineers medium classification. Boom height must be 60 cm or less above the crop or ground.

Airblast application: **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** direct spray above plants to be treated. Turn off outward pointing nozzles at row ends and outer rows. **DO NOT** apply when wind speed is greater than 16 km/h at the application site as measured outside of the treatment area on the upwind side.

DO NOT apply by air.

Buffer zones:

Use of the following spray methods or equipment **DO NOT** require a buffer zone: hand-held or backpack sprayer and spot treatment.

The buffer zones specified in the table below are required between the point of direct application and the closest downwind edge of sensitive terrestrial habitats (such as grasslands, forested areas, shelter belts, woodlots, hedgerows, riparian areas and shrublands), sensitive freshwater habitats (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands) and estuarine/marine habitats.

Method of Application	Crop		Buffer Zones (metres) Required for the Protection of:		
			Aquatic Habitat of Depths:		Terrestrial Habitat
			Less than 1 m	Greater than 1 m	
Field sprayer*	Alfalfa		1	1	4
	Fruits trees <1 year-old (apple, pear, peach plum, cherry), Apricot, Lowbush Blueberry, Corn (sweet), Birdsfoot trefoil		1	1	5
	Highbush Blueberry, Blackberry, Corn (field), Filbert, Hazelnut, Raspberry, Strawberry, Nursery stock, Woody ornamentals, Site preparation for conifer planting		1	1	10
	Asparagus, Grape, Loganberry, Apple tree >1 year-old		2	1	15
	Shelterbelt, Woodland and Christmas tree (2-year stock or older)		2	1	20
Airblast	Christmas tree and woodland plantations (2-year stock or older)	Late growth stage	15	10	40

* For field sprayer application, buffer zones can be reduced with the use of drift reducing spray shields. When using a spray boom fitted with a full shield (shroud, curtain) that extends to the crop canopy, the labelled buffer zone can be reduced by 70%. When using a spray boom where individual nozzles are fitted with cone-shaped shields that are no more than 30 cm above the crop canopy, the labelled buffer zone can be reduced by 30%.

When a tank mixture is used, consult the labels of the tank-mix partners and observe the largest, most restrictive buffer zone of the products involved in the tank mixture.

- VI) The following statements must be included in a section entitled "**ENVIRONMENTAL HAZARDS**" on product labels:

TOXIC to birds and small wild mammals.

TOXIC to aquatic organisms and non-target terrestrial plants. Observe buffer zones specified under **DIRECTIONS FOR USE**.

DO NOT apply to any body of water. **DO NOT** contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.

The use of this chemical may result in contamination of groundwater particularly in areas where soils are permeable (e.g., sandy soil) and/or the depth to the water table is shallow.

To reduce runoff from treated areas into aquatic habitats, avoid application to areas with a moderate to steep slope, compacted soil, or clay.

Avoid application when heavy rain is forecast.

Contamination of aquatic areas as a result of runoff may be reduced by including a vegetative strip between the treated area and the edge of the water body.

Product must not be mixed or loaded, or used within 15 metres of all wells, including abandoned wells, drainage wells and sink holes.

Product must not be mixed or loaded within 15 metres of intermittent streams and rivers, natural or impounded lakes and reservoirs.

One of the following restrictions must be used in applying simazine to fields containing tile drainage systems:

- Do not apply within 20 m of standpipes.
- Apply this product to the entire field and immediately incorporate it to a depth of 5 to 8 cm.
- Apply this product to the entire field under a no-till practice only when a high crop residue management practice is used. High crop residue management is described as a crop management practice where little or no crop residue is removed from the field during and after crop harvest.

Appendix V Inputs to Buffer Zone Models

Ground Use Data (from Canadian labels)				
Crop	Formulation Type	Method of Application	Number of Application	Maximum Application Rate (g a.i./ha)
Grape, Apple and Pear (trees >1 year old)	Suspension Dry flowable granules Wettable powder Solution	Field (medium)	1	4510
Highbush blueberry, blackberry	Dry flowable granules	Field (medium)	1	3380
Lowbush blueberry	Dry flowable granules	Field (medium)	1	1800
Apricot, Fruit trees (<1 year) (cherry, apple, plum, peach, pear)	Dry flowable granules	Field (medium)	1	1980
Corn (sweet)	Suspension Dry flowable granules Wettable powder Solution	Field (medium)	1	2250
Corn (field)	Suspension Dry flowable granules Wettable powder Solution	Field (medium)	1	4000
Filbert, Hazelnut	Dry flowable granules	Field (medium)	1	2250
Loganberry	Suspension Dry flowable granules Wettable powder Solution	Field (medium)	1	5400
Raspberry	Suspension Dry flowable granules Solution	Field (medium)	1	2480
Strawberry	Suspension Dry flowable granules Wettable powder	Field (medium)	2	1120
Nursery stock, Woody ornamentals	Suspension Dry flowable granules Wettable powder Solution	Field (medium)	1	3400
Christmas tree and woodland plantations	Suspension Dry flowable granules Wettable powder	Field (medium)	1	6400

Ground Use Data (from Canadian labels)				
Crop	Formulation Type	Method of Application	Number of Application	Maximum Application Rate (g a.i./ha)
Site preparation for conifer planting	Dry flowable granules	Field (medium)	1	3510
Shelter belts	Suspension Dry flowable granules Wettable powder Solution	Field (medium)	1	6750
Alfalfa	Dry flowable granules	Field (medium)	1	990
Asparagus	Suspension Dry flowable granules Wettable powder Solution	Field (medium)	2	3400
Birdsfoot trefoil	Suspension Dry flowable granules Wettable powder	Field (medium)	1	1200
Christmas tree and woodland plantations	Suspension Dry flowable granules Wettable powder	Airblast (late growth stage)	1	6400

Model Input Data for Aquatic Buffer Zones (from 2006 RED)		
Half-life for aquatic buffer zones	Stable	
Most sensitive freshwater species	<i>Anabaena flosaquae</i>	$\frac{1}{2}$ EC ₅₀ = 0.018 mg/L
Most sensitive estuarine/marine species	<i>Anabaena flosaquae</i>	$\frac{1}{2}$ EC ₅₀ = 0.018 mg/L

Model Input Data for Terrestrial Buffer Zones (from 2006 RED)		
Half-life for terrestrial buffer zones	Aerobic soil	$t_{1/2}$ = 91 days
Most sensitive terrestrial plant species	Lettuce	EC ₂₅ = 10.11 g/ha

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